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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/935,012	08/21/2001	Larry A. Coldren	510015-265	1464

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GREENBERG TRAURIG LLP  
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SANTA MONICA, CA 90404

EXAMINER

FLORES RUIZ, DELMA R

ART UNIT	PAPER NUMBER
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2828

DATE MAILED: 11/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/935,012

Applicant(s)

COLDREN ET AL.

Examiner

Delma R. Flores Ruiz

Art Unit

2828

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.


- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 9/26/2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-46 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

  
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**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 – 3, 10, 12, 13, 15 and 43 – 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of Rice et al (5,283,844).

***Regarding claims 1 – 3, and 43 - 44*** Sugiyama discloses a distributed Bragg reflector for use in vertical cavity surface emitting laser (VCSEL), comprising a group of layers of semiconductor material doped to reduce voltage drop and optical loss in a VCSEL, wherein in the group of layers there are layers of an antimonide (Sb) compound, at least some of the alternating layers having (Sb) also including the elements arsenic, aluminum and gallium (see Figs. 1 –2, 4 – 5, Column 5, lines 59 – 67, Column 6, lines 1 – 51). The pluralities of layers

of semiconductor material are epitaxially grown on a substrate (Column 5, lines 58 – 67). The substrate includes indium phosphide (InP) (Column 7, lines 48 – 49). Sugiyama discloses the claimed invention except for alternating layers of an InP compound. It would have been obvious at the time of applicant's invention, to combine Rice of teaching a alternating layers of an InP compound with a distributed DBR for use in a VCSEL because it would have been obvious to one having ordinary skill in the art at the time the invention was made to alternating layers of an InP compound, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

***Regarding claims 10 and 15*** Sugiyama discloses a distributed Bragg reflector for use in vertical cavity surface emitting laser (VCSEL), comprising a plurality of layers of semiconductor material are configured to form a reflective device and the mirror portion is n-doped to reduce voltage drop and optical loss in a VCSEL (see Figs. 1 – 2, 4 – 5, Column 2, lines 52 – 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51).

***Regarding claim 12 and 13*** Sugiyama discloses a device for reflecting light to an active region in a vertical cavity surface emitting laser VCSEL, comprising: a mirror portion including the element antimony (Sb) epitaxially grown on the substrate (Column 6, lines 42 – 52), wherein in the mirror portion there are

Art Unit: 2828

a group of layers, wherein electric current is pumped through the plurality of layers forming the mirror portion to electrically pump the active region (see Figs. 1 –2, 4 – 5, Column 2, lines 52 – 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51). The substrate includes indium phosphide (InP) (Column 7, lines 48 – 49). Sugiyama discloses the claimed invention except for group of layers being alternating layers of the InP compound and layers of the (Sb) compound. It would have been obvious at the time of applicant's invention, to combine Rice of teaching a group of layers being alternating layers of the InP compound and layers of the (Sb) compound with a distributed DBR for use in a VCSEL because it would have been obvious to one having ordinary skill in the art at the time the invention was made to group of layers being alternating layers of the InP compound and layers of the (Sb) compound, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 4 – 8, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of Rice et al. (5,392,307) further in view of "Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy" by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999).

**Regarding claims 4 – 8**, Sugiyama in view of Rice discloses the claimed invention except for the distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light. It would have been obvious at the time of applicant’s invention, to combine “Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy” by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999) of teaching a distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light with DBR and VCSEL because it would have been obvious to one of ordinary skill in the art at the time the invention was made to distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate

Art Unit: 2828

relative proportions of atoms and "a" is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Claims 17, 18, 27, 29, 30, 31, 32, 41, 42, 45 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of Rice et al (5,392,307) further in view of WO 98/07218, Jayaraman (February 19, 1998).

***Regarding claims 17, 18, 27, 29, 30, 31, 32, 41, 42, 45, and 46,***

Sugiyama in view of Rice discloses VCSEL comprising; a pair of mirror portion epitaxially grown on a substrate the pair of the mirror portions including a group of layers stacks of paired semiconductor material, wherein the pair of mirror portions are n-doped of reduce voltage drop and optical loss; wherein each of pairs of mirror portion includes at least one of the element antimony (Sb) (Column 6, lines 42 – 52); wherein in each of the pair of mirror portions there are a group of layers; an active region epitaxially grown on the substrate and

Art Unit: 2828

positioned between the pair of mirror portions (see Figs. 1 –2, 4 – 5, Column 2, lines 52 - 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51); the substrate includes InP (Column 7, lines 48 – 49). The pairs of mirror portion includes a first mirror portion positioned on a top of the active region and a second mirror portion positioned below the active region and the active region is grown to include a cavity having five strain compensated quantum wells, the quantum wells including the elements aluminum, indium, gallium and arsenic, the VCSEL operates in the approximate range from between 1.3  $\mu\text{m}$  and 1.6 $\mu\text{m}$  and a substrate on which a pair of mirror portions, an active region and at least one metal contact disposed on the substrate, wherein electric current is pumped through the pair of mirror portions to electrically pump the active region (see Figs. 1 –2, 4 – 5, Column 2, lines 52 - 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51).

Sugiyama in view of Rice discloses the claimed invention except for a doped tunnel junction configured to provide electron-hole conversion from one of the pair of mirror portion; and wherein the pair of a mirror portions, the active region and the tunnel junction are epitaxially grown on the substrate in a single step, and wherein electric current is pumped through the pair of mirror portions to electrically pump the active region and a tunnel junction are epitaxially grown in a single step in which semiconductor elements are deposited to form a multi-layered structure and mirror portion including at least one layer being substantially composed of an InP. It would have been obvious at the time of



applicant's invention, to combine WO 98/07218, Jayaraman (February 19, 1998) of teaching a doped tunnel junction configured to provide electron-hole conversion from one of the pair of mirror portion; and wherein the pair of a mirror portions, the active region and the tunnel junction are epitaxially grown on the substrate in a single step, and wherein electric current is pumped through the pair of mirror portions to electrically pump the active region and a tunnel junction are epitaxially grown in a single step in which semiconductor elements are deposited to form a multi-layered structure. It would have been obvious at the time of applicant's invention with VCSEL because a vertical cavity surface emitting laser (VCSEL) includes a bottom mirror stack disposed above a semiconductor substrate, an optical cavity including an active region disposed above the bottom mirror stack, and a top mirror stack disposed above the optical cavity. A tunnel junction interface between an n-doped layer of GaAs and a p-doped layer of GaAs for converting electrons to holes is incorporated in the optical cavity or in the period of either of the mirror stacks adjacent the optical cavity. The tunnel junction interface effectively converts n carriers to p carriers, which eliminates the need for a p-type contact. As a result, the VCSEL is able to include a second n-type contact, rather than the p-type contact suggested by conventional techniques, and a thin p-doped GaAs layer. The advantages of having a second n-type contact rather than a p-type contact include a lower electrical resistance and lower optical loss for the VCSEL. When the invention is embodied in a VCSEL with an intracavity contact, one of the mirrors can be

Art Unit: 2828

undoped. This further reduces optical loss for the VCSEL. The VCSEL can be electrically pumped using first and second contacts to n-material portions of the VCSEL to emit coherent electromagnetic radiation having a wavelength in a range from 1250 nm to 1650 nm.

Sugiyama discloses the claimed invention except for alternating layers of an InP compound and layers of an (Sb). It would have been obvious at the time of applicant's invention, to combine Rice of teaching a alternating layers of an InP compound with a distributed DBR for use in a VCSEL because it would have been obvious to one having ordinary skill in the art at the time the invention was made to alternating layers of an InP compound and layers of an (Sb), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 9, 11, 14, 16, 24 – 26, 28, and 38 – 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of Rice et al. (5,392,307) further in view of in view of WO 98/07218, Jayaraman (February 19, 1998).

**Regarding claims 9, 11, 14, 16, 24 – 26, 28, and 38 – 40** Sugiyama in view of Rice discloses the claimed invention except for the substrate is n-doped

Art Unit: 2828

with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is n-doped with silicon (Si), and the doped tunnel junction is p-doped with CBr<sub>4</sub>. It would have been obvious at the time of applicant's invention, to combine WO 98/07218, Jayaraman of teaching a substrate is n-doped with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is n-doped with silicon (Si), and the doped tunnel junction is p-doped with CBr<sub>4</sub>. It would have been obvious at the time of applicant's invention with VCSEL and DBR because it would have been obvious to one having ordinary skill in the art at the time the invention was made to substrate is n-doped with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is n-doped with silicon (Si), and the doped tunnel junction is p-doped with CBr<sub>4</sub>. It would have been obvious at the time of applicant's invention, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 19 – 23, and 33 – 37, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of Rice et al (5,392,307) further in view of "Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy" by G. Almuneau, E. Hall, S.

Art Unit: 2828

Mathis and L.A. Coldren (July 26, 1999) and WO 98/07218, Jayaraman

(February 19, 1998).

**Regarding claims 19 – 23, and 33 – 37** Sugiyama in view of Rice discloses the claimed invention except for the distributed Bragg reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or less than 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light. It would have been obvious at the time of applicant’s invention, to combine “Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy” by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999) of teaching a distributed Bragg reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or less than 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light with DBR and VCSEL because it would have been obvious to one of ordinary skill in

Art Unit: 2828

the art at the time the invention was made to distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where "a" and "b" indicate relative proportions of atoms and "a" is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1 - 14 have been considered but are moot in view of the new ground(s) of rejection. Applicants amendments raised new issues that made necessary the new art to be applied and therefore, the arguments presented against Sugiyama et al are said to be moot due to the new grounds of rejection. Applicant's amendments have been fully addressed by the above-presented rejection.


Art Unit: 2828

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Delma R. Flores Ruiz whose telephone number is (703) 308-6238. The examiner can normally be reached on M - F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (703) 308-3098. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-3431.

  
Delma R. Flores Ruiz  
Examiner  
Art Unit 2828

  
Paul Ip  
Supervisor Patent Examiner  
Art Unit 2828

DRFR/PI  
November 6, 2003